A STUDY OF TASTE PERCEPTION AND DIETARY INTAKE OF ELDERLY ALBERTANS

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PROJECT NO. U of A 55-66036
SENIOR CITIZENS BUREAU
ALBERTA SOCIAL SERVICES & COMMUNITY HEALTH
JANUARY, 1988

Discussion

Taste perception of the elderly women was found to be less acute than that of the young for both sourness and saltiness. The ratios of the slopes generated by the young to those generated by the elderly were as follows: for sourness; 1.64 for the aqueous system and 1.82 for the food system: for saltiness; 1.42 for the aqueous system and 1.19 for the food system. The results showed that the effects of aging on suprathreshold taste sensation are less marked for saltiness than for sourness. Hyde and Feller (1981) also found that the age effect on the taste functions of saltiness was less than that on sourness.

relationship was observed. In the food system, both groups showed a parabolic function. A significant age x concentration interaction was found in aqueous solutions ($p<0.01$). Pleasantness responses were compared between the aqueous and food systems. For the young group, a significant effect of system ($p<0.05$) and a significant system x concentration interaction ($p<0.001$) were determined.

Range of variability of taste intensity data. The average slopes of taste intensity obscure the range in individual values. Within each age group the slopes of taste intensity functions were ranked in decreasing order and two equal subgroups created: subgroup I exhibited steeper taste intensity slopes and subgroup II had flatter slopes (Table 4). Subgroup I, with steeper taste intensity slopes, had more variable taste responses than subgroup II. Subgroup I exhibited larger variability in pleasantness ratings than subjects in subgroup II. Subgroup I showed narrower ranges of preference and a greater dislike of stimulus concentrations at both limits of the suprathreshold range than did those in subgroup II.

Relationships between taste intensity data of subgroups and nutritional risk. One of the most important findings was that, for the elderly, the subgroup with steeper slopes of taste intensity (subgroup I, n=15) was at greater nutritional risk than the subgroup with flatter slopes (subgroup II, n=15), as shown in Figures 7 and 8. The

patterns of pleasantness responses revealed that for both the elderly and the young, subgroup I exhibited strong likes and dislikes for both sourness and saltiness.

Statistical analyses of relationships between taste perception data and dietary intake measurements revealed a consistent positive correlation between the risk of vitamin A deficiency and the slope of taste intensity. For the elderly significant positive correlations were found between the percent risk of vitamin A deficiency and the slopes of all taste functions; for sourness in the aqueous ($p<0.05$) and food systems ($p<0.05$); for saltiness in the aqueous ($p<0.05$) and food systems ($p<0.001$). These correlations suggest that vitamin A intake particularly may influence taste perception.

Discussion

Taste perception of the elderly women was found to be less acute than that of the young for both sourness and saltiness. The ratios of the slopes generated by the young to those generated by the elderly were as follows: for sourness; 1.64 for the aqueous system and 1.82 for the food system: for saltiness; 1.42 for the aqueous system and 1.19 for the food system. The results showed that the effects of aging on suprathreshold taste sensation are less marked for saltiness than for sourness. Hyde and Feller (1981) also found that the age effect on the taste functions of saltiness was less than that on sourness.

The present study also showed that results for aqueous solutions and simple food systems were dissimilar. The intensity ratings of tastants were found to be significantly lower in the food system than in the aqueous system at the higher concentrations, although this difference was less for the elderly than for the young.

Taste pleasantness responses for the elderly and the young were found to be dissimilar. Taste preference is important because it ultimately influences the type of diet we eat. Aging may make food taste less pleasant and thus lessen the enjoyment of eating. This could be an important factor contributing to the dietary inadequacies often observed among the elderly.

The methodology used for the quantitative assessment of taste perception proved to be effective for testing both the elderly and the young. An initial training session on the method of magnitude estimation encouraged subjects to use a wide variety of numbers and to make ratio judgements. The method used to assess dietary intake was also found to be effective. One researcher (S. Ko) collected all the dietary data and reviewed the food record with the subject each time to ensure that enough information was obtained. Kohrs et al. (1980) used a combined recall and food record method and found that the food record overcame some of the problems encountered when one relies on the older individual to remember everything consumed.

The dietary data collected in this study indicate that,

in general, the elderly had poorer diets than the young. Energy and protein intakes of the elderly were significantly lower than those of the young. Seven percent of the elderly group were classified as being at risk for protein deficiency. The percent risk of inadequacy for folacin and calcium was significantly greater for the elderly than the young. Marginal nutritional status is of particular significance in the elderly because homeostatic mechanisms are often impaired and physiological balance may be more readily upset (Exton-Smith, 1972; Panel on Nutrition, 1972).

Significant correlations were found between percent risk of vitamin A deficiency and taste perception parameters. Other researchers have shown vitamin A deficiency to be related to abnormal taste sensation in humans (Briggs and Duncan, 1961; Sauberlich et al., 1974; Hodges and Hodges, 1980; Garrett and Russell, 1980) and in animals (Bernard et al., 1961).

Vitamin A deficiency has only been documented on rare occasions in the elderly in North America. Baker et al. (1979) and Nutrition Canada (1973) found that serum vitamin A levels were adequate for the group of elderly studied. However, Harrill and Cervone (1977) reported that 17 percent of elderly free-living women had low serum vitamin A levels. Yearick et al. (1980) showed that 24 percent of elderly women did not consume adequate vitamin A.

The quantitative assessment of taste perception revealed considerable individual variation (for both intensity and

pleasantness). For the elderly and young, greater deviation in taste intensity response was associated with an alteration in taste preference. Lundgren et al. (1978) and Trant and Pangborn (1983) have described several distinctive preference response patterns to increasing taste stimulus intensity and illustrated that subjects could be classified according to their preference responses.

For the elderly a relationship was found between deviation in taste intensity response, as revealed by high values for slopes of taste intensity function (subgroup I) and the index of nutritional risk. For the elderly, the mean index of nutritional risk was significantly higher for subgroup I than for subgroup II for both taste qualities in the food systems (sourness $p<0.05$, saltiness $p<0.01$). It is important to note that for the young group, no relationship was found between taste parameters and index of nutritional risk. For both sourness and saltiness, the food system was more useful in discriminating among subgroups of elderly subjects than was the aqueous system.

Conclusions

This study indicates that for some of the elderly during aging, poor nutrient intake may interact to produce adverse effects on taste perception. The direction of the relationship between taste perception and dietary adequacy needs to be explored. It may be possible to improve taste perception for some of the elderly women by improving

nutrient intake. Deficits in suprathreshold taste perception and dietary status appear to play a role in determining food preferences.

Results for Study 2 (Men)

Findings from this project suggest that relationships between some of the taste qualities and specific nutrients also exist for males. The thesis is now being prepared.

Titles for tables

Table 1: Characteristics of groups

Table 2: Mean daily nutrient intake

Table 3: Mean percent risk that observed intake is below requirement.

Table 4: Slopes for intensity of the sourness and saltiness taste qualities for the subgroups.

Table 1. Characteristics of groups

Characteristics	Elderly	Young
Number of subjects	30	30
Age (years)	73.7 ± 0.5	24.3 ± 0.5[1]
Height (cm)	159.0 ± 1.1**	164.0 ± 1.3**
Weight (kg)	69.0 ± 2.5***	58.2 ± 1.3***
TSF[2] (mm)	26.9 ± 1.3***	19.8 ± 1.2***

[1]mean ± standard error of the mean.

[2]triceps skinfold thickness.

*,**,***significant at $p < 0.05$, 0.01, 0.001, respectively.

Table 2. Mean daily nutrient intake

Nutrient	Elderly[1]	Young[1]
Energy (kcal)	1560 ± 66***	1893 ± 67[2]
Protein (g)	59.8 ± 2.3***	72.0 ± 3.3
Fat		
Total (g)	64.6 ± 3.8	71.3 ± 3.4
Cholesterol (mg)	295 ± 22	303 ± 23
Carbohydrate		
Total (g)	194 ± 10***	244 ± 10
Dietary fiber (g)	18.4 ± 1.6	16.7 ± 1.2
Sugar (g)	91 ± 6**	115 ± 6
Starch (g)	82 ± 4***	105 ± 6
Thiamin (mg)	1.30 ± 0.07	1.36 ± 0.07
Riboflavin (mg)	1.50 ± 0.08*	1.75 ± 0.10
Preformed niacin (mg)	14.8 ± 0.8	16.7 ± 0.9
Vitamin B_6 (mg)	1.3 ± 0.1	1.5 ± 0.1
Vitamin B_{12} (mcg)	3.8 ± 0.7	4.7 ± 1.0
Total folacin (mcg)	178 ± 14	200 ± 13
Ascorbic acid (mg)	123 ± 12	147 ± 15
Vitamin A (RE)	1148 ± 161	1247 ± 204
Vitamin A (IU)	6283 ± 690	6982 ± 843
Vitamin D (IU)	186 ± 16	189 ± 18
Calcium (mg)	758 ± 45**	1003 ± 66
Phosphorus (mg)	1142 ± 60**	1382 ± 68
Iron (mg)	12.5 ± 0.6	13.2 ± 0.5
Sodium (mg)	2240 ± 111*	2635 ± 143
Potassium (mg)	2568 ± 151	2900 ± 122
Zinc (mg)	7.8 ± 0.4*	9.3 ± 0.5

[1] $n = 30$.

[2] mean ± standard error of the mean.

*,**,*** significant at $p < 0.05$, 0.01, 0.001, respectively.

Table 3. Mean percent risk[1] that observed intake is below requirement

Nutrient	Elderly[2]	Young[2]
	(%)	(%)
Protein	7.0 ± 3.8	0.2 ± 0.2[3]
Thiamin	2.9 ± 1.8	0.1 ± 0.1
Riboflavin	4.1 ± 2.9	0.2 ± 0.2
Vitamin B_6	0.2 ± 0.2	1.4 ± 0.7
Vitamin B_{12}	3.7 ± 3.3	2.3 ± 1.8
Total folacin	39.0 ± 7.5*	16.1 ± 5.2
Ascorbic acid	5.9 ± 4.0	1.8 ± 1.5
Vitamin A	11.6 ± 5.0	10.9 ± 4.9
Vitamin D	11.2 ± 5.2	9.6 ± 5.0
Calcium	31.1 ± 7.2**	6.1 ± 3.5
Iron	0.2 ± 0.1***	8.7 ± 1.3
Zinc	23.3 ± 6.4	10.6 ± 3.6

[1]microcomputer software package "Probability Assessment of Nutrient Intake".

[2]n = 30.

[3]mean ± standard error of the mean.

*,**,*** significant $p<0.05$, 0.01, 0.001, respectively.

Table 4. Slopes for intensity of the sourness and saltiness taste qualities for the subgroups

Slope of taste intensity	Elderly Subgroup[1] I	Elderly Subgroup[1] II	Young Subgroup[1] I	Young Subgroup[1] II
Sourness:				
Aqueous	.64[2] (.45-.90)[3]	.30 (.15-.44)	.99 (.72-1.67)	.55 (.25-.71)
Food	.50 (.30-.75)	.15 (.05-.25)	.80 (.61-1.16)	.39 (.07-.59)
Saltiness:				
Aqueous	.66 (.48-1.11)	.34 (.09-.47)	.89 (.71-1.16)	.52 (.28-.69)
Food	.57 (.42-1.53)	.27 (.11-.39)	.65 (.49-.97)	.36 (.12-.48)

[1] n = 15.

[2] mean slope of the subgroup.

[3] range of the slope values.

Titles for Figures

Figure 1: Mean taste intensity estimates of citric acid in aqueous and food systems.

Figure 2: Mean taste intensity estimates of sodium chloride in aqueous and food systems.

Figure 3: Mean taste pleasantness estimates of citric acid in aqueous and food systems.

Figure 4: Mean taste pleasantness estimates of sodium chloride in aqueous and food systems.

Figure 5: Index of nutritional risk for the elderly and young subgroups: sourness.

Figure 6: Index of nutritional risk for the elderly and young subgroups: saltiness.

Figure 1

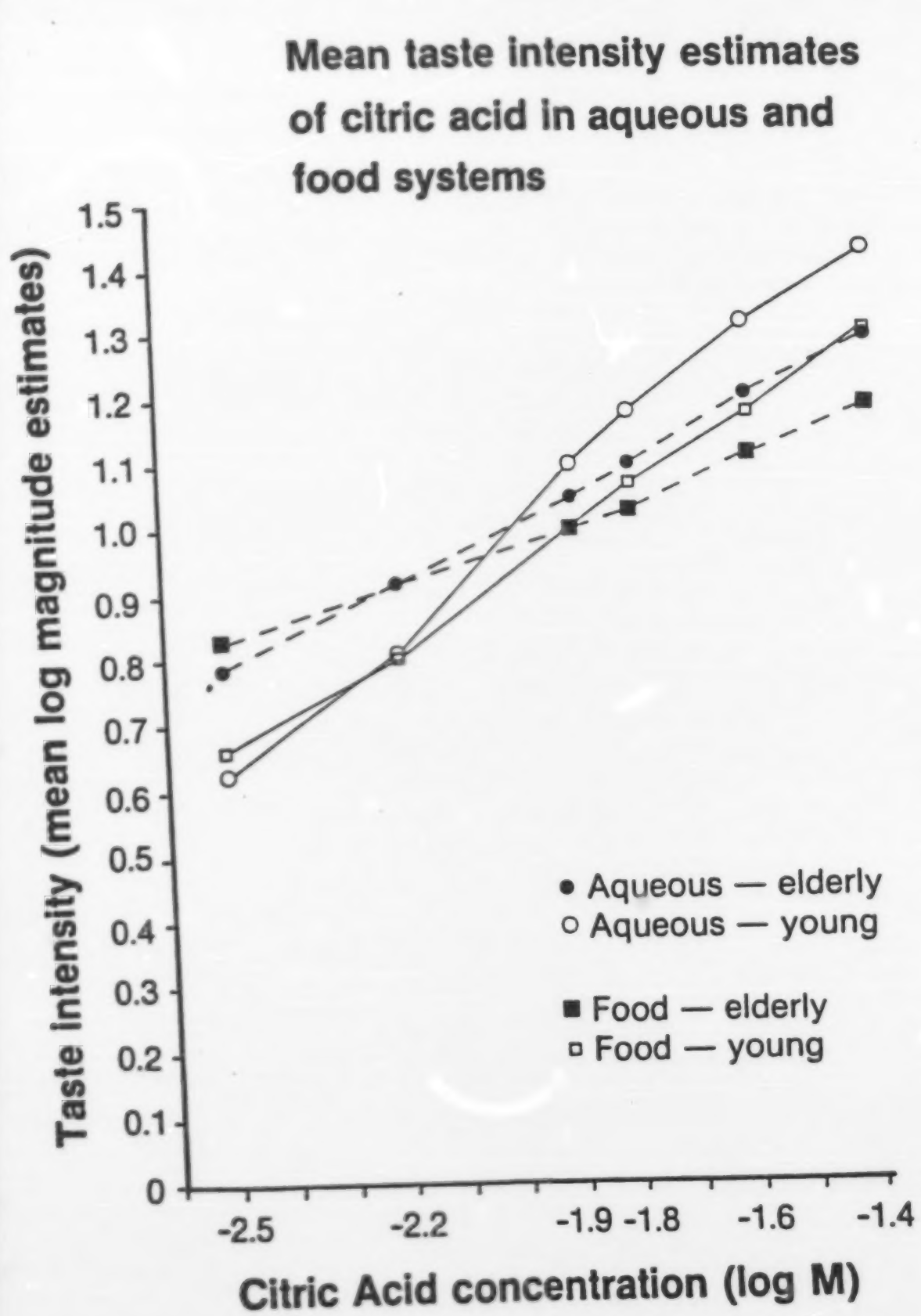

Mean taste intensity estimates of citric acid in aqueous and food systems
Taste intensity (mean log magnitude estimates)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-2.5
-2.2
-1.9
-1.8
-1.6
-1.4
Citric Acid concentration (log M)
Aqueous — elderly
Aqueous — young
Food — elderly
Food — young

Figure 2

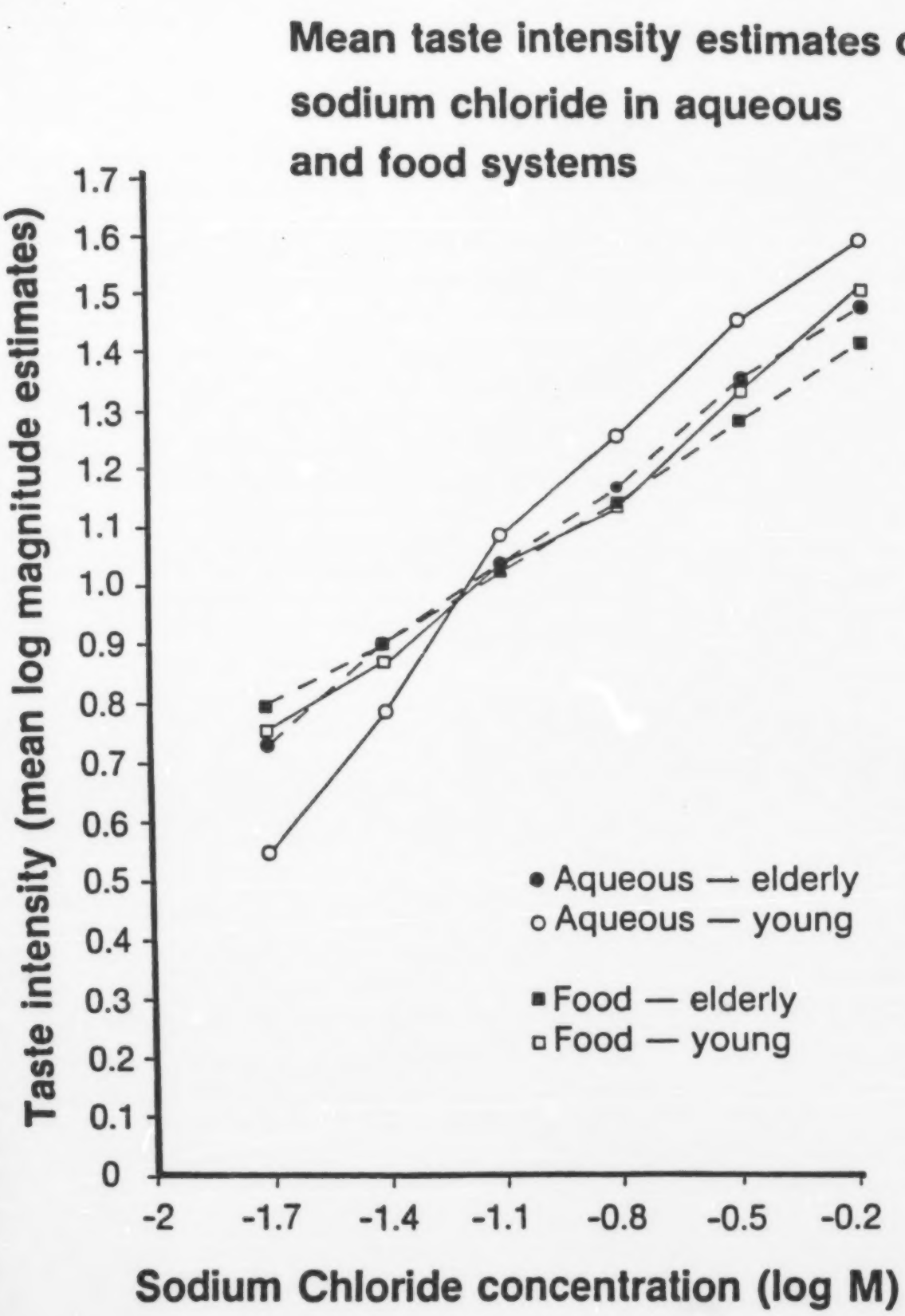

Mean taste intensity estimates of sodium chloride in aqueous and food systems
Taste intensity (mean log magnitude estimates)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-2
-1.7
-1.4
-1.1
-0.8
-0.5
-0.2
Sodium Chloride concentration (log M)
Aqueous — elderly
Aqueous — young
Food — elderly
Food — young

Figure 3

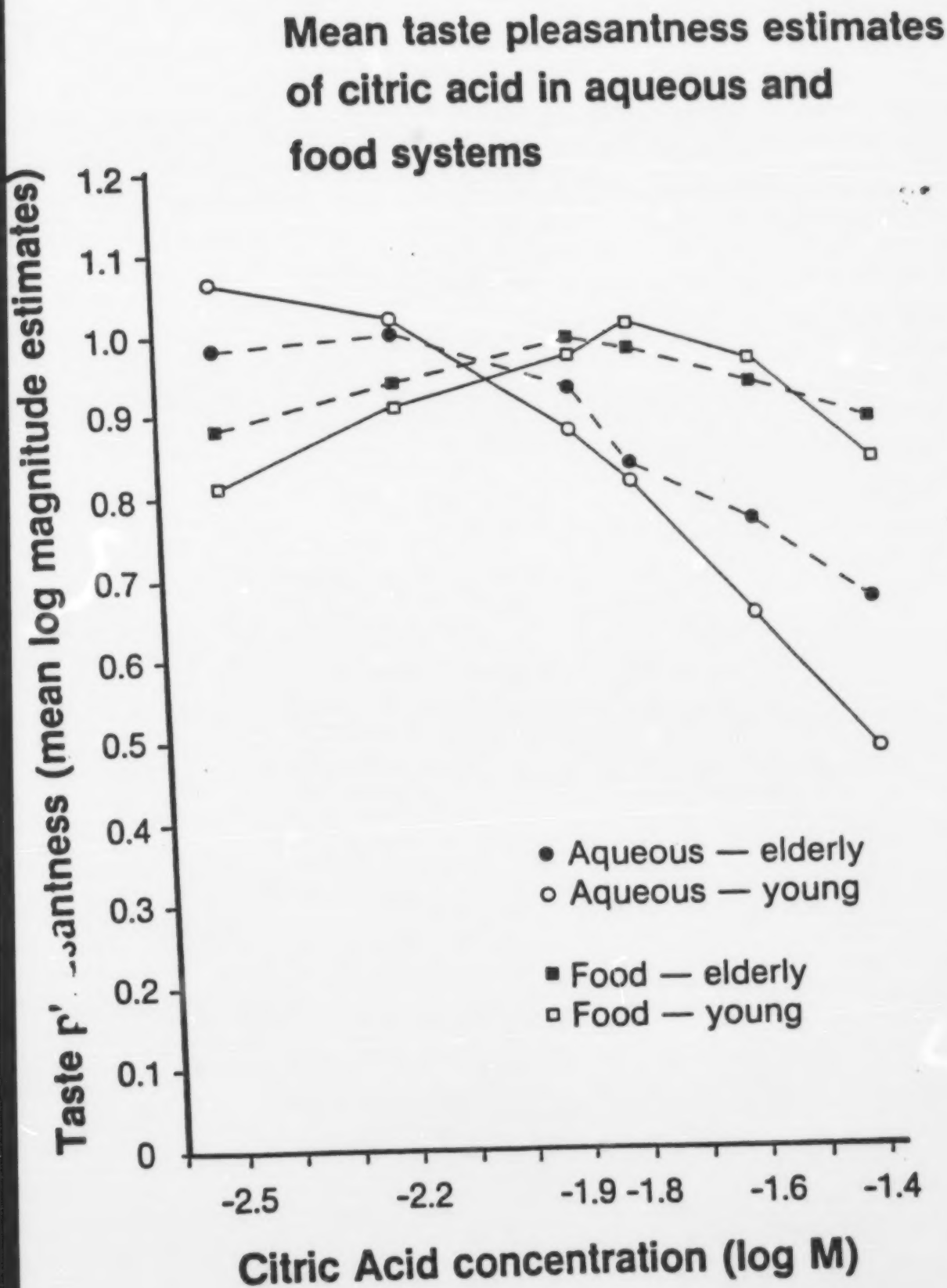

Mean taste pleasantness estimates of citric acid in aqueous and food systems
Taste pleasantness (mean log magnitude estimates)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-2.5
-2.2
-1.9
-1.8
-1.6
-1.4
Citric Acid concentration (log M)
Aqueous — elderly
Aqueous — young
Food — elderly
Food — young

Figure 4

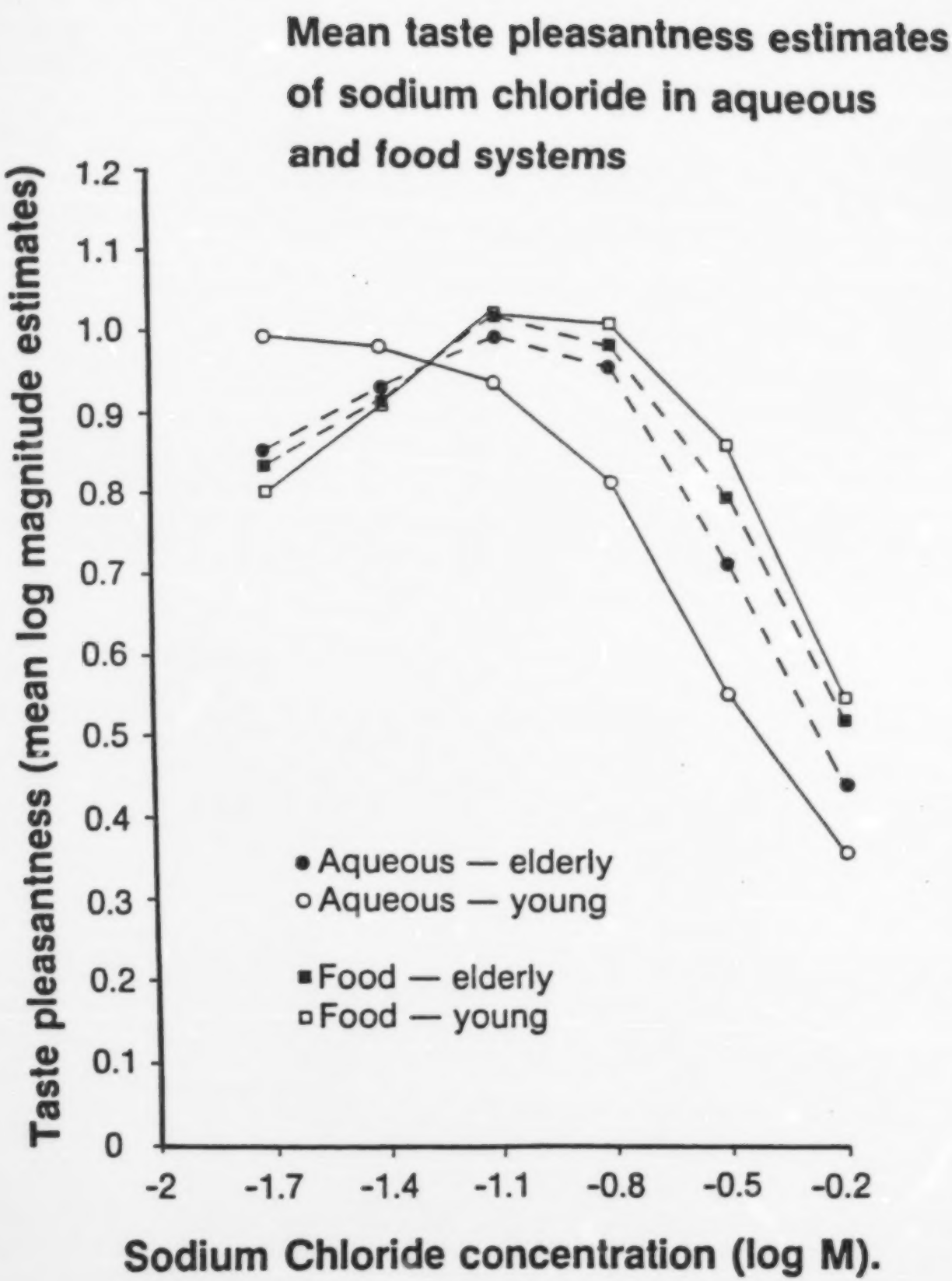

Mean taste pleasantness estimates of sodium chloride in aqueous and food systems
Taste pleasantness (mean log magnitude estimates)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Aqueous — elderly
Aqueous — young
Food — elderly
Food — young
-2
-1.7
-1.4
-1.1
-0.8
-0.5
-0.2
Sodium Chloride concentration (log M).

Figure 5

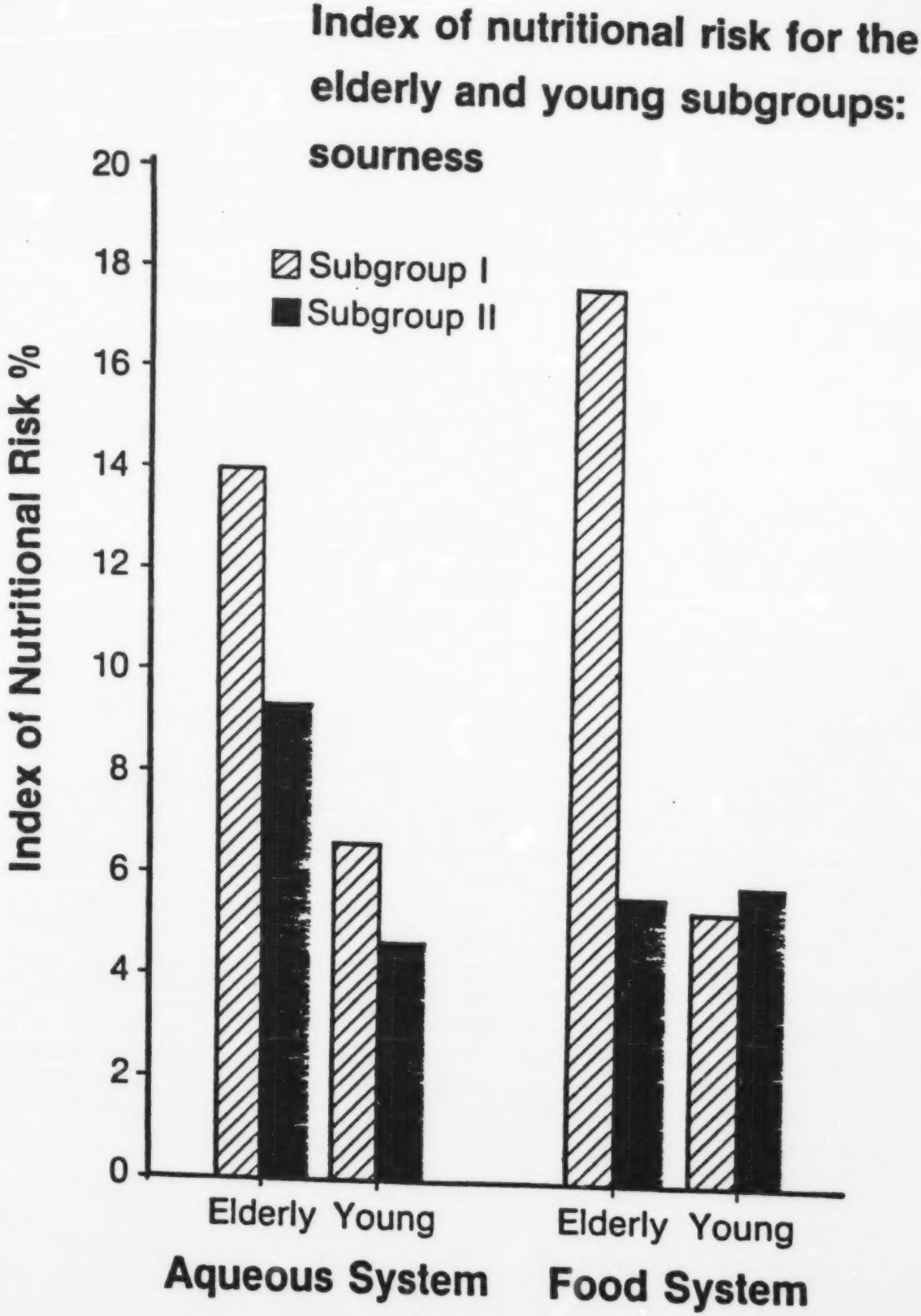
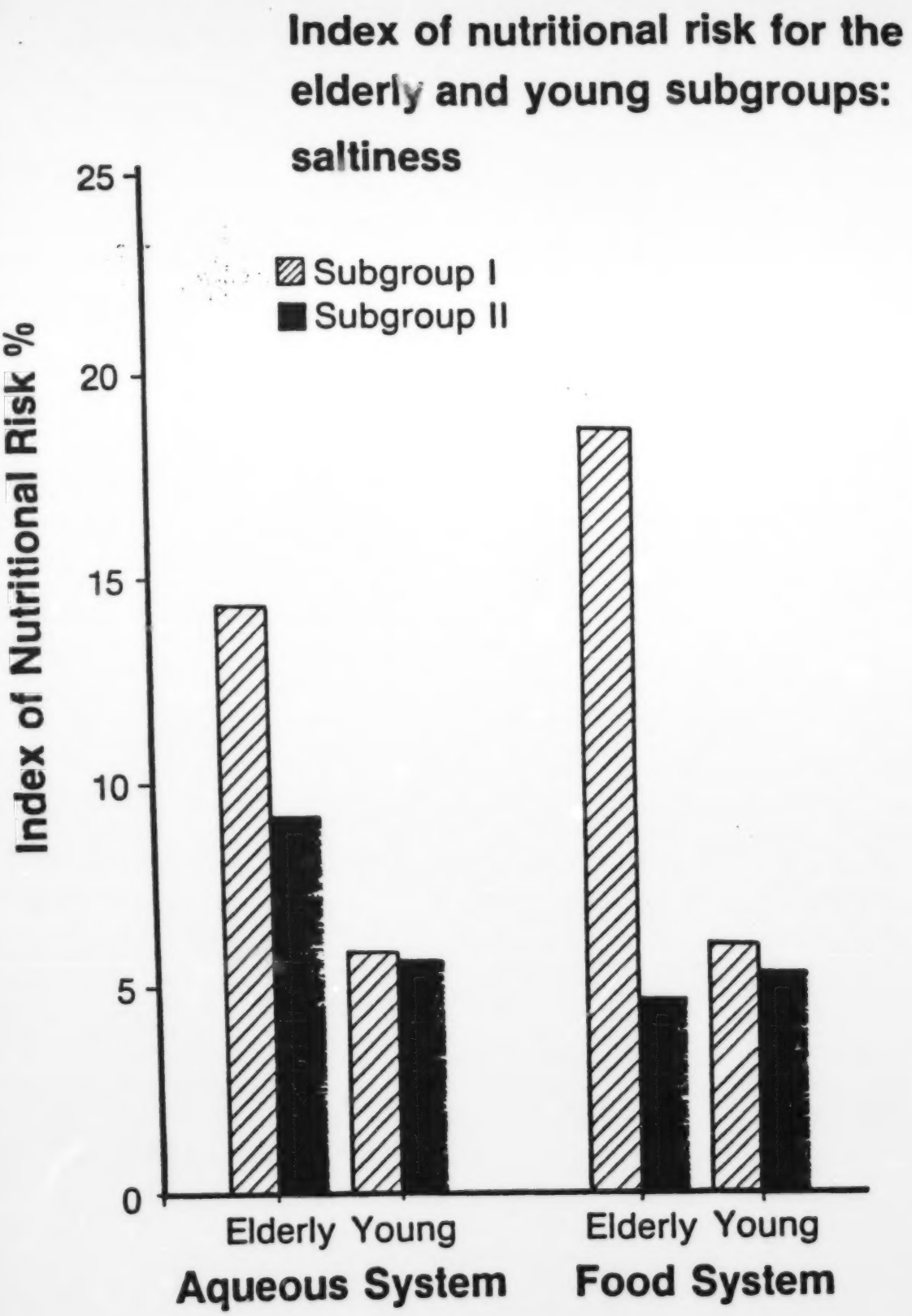

Index of nutritional risk for the elderly and young subgroups: sourness
Subgroup I
Subgroup II
Index of Nutritional Risk %
20
18
16
14
12
10
8
6
4
2
0
Elderly Young
Elderly Young
Aqueous System
Food System

Figure 6


Index of nutritional risk for the elderly and young subgroups: saltiness
Subgroup I
Subgroup II
Index of Nutritional Risk %
25
20
15
10
5
0
Elderly Young
Aqueous System
Elderly Young
Food System